APPENDIX I

TECHNOLOGICAL ANALYSIS OF TEXTILES AND FIBERS

The following is the complete text of the Textile and Fiber Analysis report
as submitted.

PREHISTORIC TEXTILE REMNANTS AND OTHER EVIDENCE OF NATIVE FIBER INDUSTRIES FROM THE WHITEHURST FREEWAY PROJECT SITES

by

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ABSTRACT

Prehistoric textile remnants recovered from a ceremonial feature in the Whitehurst Freeway Project, located in Washington, D.C., have been dated to the late Middle Woodland period. Although highly fragmentary, at least one or perhaps two twined fabrics are represented in the sample of extant fiber artifacts, along with additional cordage elements which are likely related to the fabric(s). Extremely rare in local and regional contexts, these specimens constitute a very important aspect of the overall artifact inventory. More copious evidence of other fiber industries is represented in the overall artifact inventory as negative impressions on prehistoric ceramics, including Early Woodland, Middle Woodland and Late Woodland examples. Comparison of these two data sets reveals both continuity and discontinuity in the fiber artifacts, suggesting a local population replacement, or some other change, between the Middle Woodland and Late Woodland periods, after ca. A.D. 600-800.

INTRODUCTION

Few, if any, categories of material culture preserve evidence of basic anthropological concern as well as native fiber industries do. Whether ethnographic and largely whole, or archaeological and fragmentary, native fiber industries typically preserve evidence related to technology, economic adaptation and social identity, among other issues. In spite of these potential contributions, native fiber industries remain incompletely known in most anthropological contexts and this is especially the case in the archaeological record. Conditions of preservation typically preclude archaeological recovery of such artifacts, except in the case where they are preserved on some other medium, like pottery, or under more unusual conditions of waterlogging, carbonization, aridity or biotic sterilization, etc. (Petersen 1996a; Heckenberger et al. 1996).

This is particularly the case in eastern North America, or the East, where preservation of extant native fibers and other organic artifacts is quite rare indeed (e.g., Miner 1936; Petersen 1996a). Evidence of fiber artifacts on prehistoric pottery made over a span of 2500-3000 years is preserved much more commonly in the East, often times representing the dominant form of ceramic surface finish and/or decoration (e.g., Coe 1995; Custer 1989, 1996; Dent 1995; Egloff 1985; Evans 1955; Hantman and Klein 1992; Potter 1993; Stewart 1994). However, details about eastern fiber artifacts themselves have been only rarely collected and reported to date, due, at least in part, to a general lack of familiarity with these industries, including cordage, basketry and closely related fabrics, among others.

Meaning to help address this deficit, this report presents data and interpretation of one or two prehistoric fabrics, represented by numerous specimens, from archaeological site 51NW117 (the Ramp 3 area) within the Whitehurst Freeway Project in Washington, D.C. Along with two closely related sites or site areas, 51NW103 (Peter House) and 51NW117W (Whitehurst West), site 51NW117 is situated close to Rock Creek and its confluence with the Potomac River in the Foggy Bottom area of Washington, which is, in turn, situated in the Mid-Atlantic region of the East.

The extant fiber artifacts have been generally dated to the Middle Woodland period of regional prehistory on the basis of their association with dates of A.D. 620-790 for feature 283, a ceremonial burial pit containing cremated human remains and various artifacts, along with the fragmentary fabric(s). One or more fabrics were seemingly used to bundle a previously cremated human and grave goods of various sorts. When the partially infilled surface of the pit burial was burned, various pieces of the fabric(s) survived due to carbonization, but only as very small fragments. An additional sample of 70 variably known fiber artifacts have been reconstructed from negative impressions on pottery from all three sites or site areas (i.e., 51NW103, 51NW117 and 51NW117W). These have been included in this analysis to augment the details derived from the extant fabric(s) and to provide a broader basis for comparison. This ceramic-derived sample can be also generally dated on the basis of age estimates for the pottery and eight radiocarbon dates directly obtained from the carbonized organic residue on the interior surfaces of these vessels. This sample allows the extant fabric(s) to be set within a broader context, enabling comparison over time and with a few other samples known from the region.

After a brief description of relevant analytical criteria, the extant samples are described, including primarily technical attribute identifications. Then the specimens preserved as negative impressions are briefly described by technological type and time period to which they can be attributed. Finally, broader correlations are mentioned and the role of the overall fiber artifact sample from the Whitehurst Freeway Project is discussed as it relates to regional prehistory.

ANALYTICAL CRITERIA

Native fiber industries are one category of a broader class of organic artifacts which can be collectively labeled as "perishables." Fiber artifacts include, but are not limited to, cordage, basketry, other fabrics, netting and complex cordage constructions, and they are sometimes collectively labeled as "textiles" in a broad use of this term. Although richly represented in some ethnographic contexts, organic fiber artifacts rarely survive in the archaeological record, except as negative impressions on some other medium, as noted above.

Following Adovasio and Andrews (with Carlisle) (1980:34), cordage is considered "a class of elongate fiber constructions, the components of which are generally subsumed under the common terms 'string' and 'rope'." Cordage undoubtedly served a wide variety of functions in aboriginal societies, including its use as a tool for ceramic decoration and surface finish of ceramics (Hurley 1979). Netting is considered a "class of openwork fabrics built up by the repeated interworking of a single continuous element with itself" (Adovasio and Andrews[with Carlisle] 1980:27; see Emery 1980).

Complex or composite constructions of cordage include: 1) cord-wrapped "cords," or cordage wrapped around a thin, obviously flexible foundation; 2) cord-wrapped "sticks," or cordage wrapped around a thin, linear, largely rigid foundation; and 3) cord-wrapped "paddles," or cordage wrapped around a broad, flat, largely rigid implement. The latter two constructions are reconstructed herein, but no cord-wrapped cords were recognized. In the Mid-Atlantic region, net-wrapped "paddles" and fabric-wrapped "dowels," or "plaited dowels," are also known and are common in some contexts, although the latter may be similar to cord-wrapped sticks, or even fabrics made using rigid warps, reflecting some degree of terminological imprecision.

Of particular note, the cord-wrapped paddles have been distinguished from fabrics, etc., per se on the basis of a series of parallel, discrete, non-interwoven elements, even though little evidence of the paddles can be typically discerned (except where applied unevenly and an edge of the paddle can be discerned as a linear divot). Similarly, although the use of "stick" or "cord" foundations can be only rarely distinguished clearly, these terms are used as a semantic convention to differentiate between the usage of a rigid versus non-rigid foundation around which the cordage was wrapped. These complex manipulations of cordage and netting were apparently manufactured primarily--or perhaps solely-- as tools for the decoration and/or surface finish of ceramics (Hurley 1979).

Basketry is a diverse class of perishables woven without a frame or loom, and commonly includes three major manufacture techniques: coiling, plaiting and twining. Of these three techniques, only twining is represented herein, although plaiting (or "interlacing") must have been known to the original craftspeople and it has been alternatively reconstructed for one of the extant fabrics, differing from the present analysis, as discussed below. In any case, twining is "manufactured by passing moving (active) horizontal elements called wefts around stationary (passive) vertical elements or warps," and it is employed in the production of containers, mats, bags, fishtraps, cradles, hats, clothing and other less typical specimens (Adovasio 1977; Adovasio and Andrews [with Carlisle] 1980:33).

Cordage and more complex constructions made from cordage, and twined basketry (or fabrics) typically exhibit a characteristic twist, or weft slant, as used specifically to describe their final configuration, respectively. An initial spin usually pertains as well, and it is typically opposite that of the final twist, thereby locking the spun and twisted elements together. In both cases, one can twist or spin only to the "left" in a Z direction (down to the left and up to the right), or to the "right" in an S direction (down to the right and up to the left). As described more fully below, these simple attributes are important for broader reconstructions since most archaeological and ethnographic populations only make them one way or the other (Petersen 1996a:13-15). Where represented, careful attention was paid to these attributes as a result.

The individual extant specimens were only examined in the laboratory of Parsons Engineering Science, Inc., in Fairfax, Virginia, over a portion of one day and then further studied through black & white, and color slide photographs thereafter. This means that the following observations are somewhat preliminary and may be further amplified, or revised, through further study of the specimens first hand. Nonetheless, systematic analysis was undertaken generally following standard works for the analysis of archaeological specimens of twined basketry and cordage (e.g., Advise 1977; Hurley 1979). All measurements were made using Helios needle-nosed calipers accurate to 0.05 mm.

The fiber artifact impressions, including 70 examples of various technological types, were studied in a comparable fashion, although metric attribute collection has not been yet completed for this sample (Tables 1-5). In most cases, the actual ceramic specimens were provided to the author and positive casts were made at the University of Vermont using Roma plasticene (see Tables 1-3). Another group of specimens, many off for thin-section analysis at the time, was studied solely through the use of clear, sharp photographs supplied by Parsons. Thus, these two levels of investigation have different degrees of certainty attached to them and as can be seen in the data, considerably fewer of the specimens studied solely through the photos could be reliably reconstructed (see Table 4).

Care was taken to produce whole, uncracked, durable casts from the impressions, but this calls for careful kneading prior to application of the plasticene and one needs to be careful not to crack the sherds during application. In fact, usually only one or possibly two casts should be taken (ever?) for any given specimen because of an inevitable buildup of a thin film of plasticene on the ceramic surface, rendering later casts, if taken, less clear and sometimes broken in removal; a light application of "dust" on the filmed surface will sometimes enable later casts to be taken. In any case, the use of plasticene in casting has its advantages, but it should not be used indiscriminately, nor should it be done where a given ceramic surface might be, for example, dated on the basis of adhering residue, among other potential avenues of investigation, unless those analyses can be done first, as was done in this case.

The fiber artifacts were reconstructed using the sherds themselves, first as a source of one or more positive casts that were made of each impression. Secondly, examination of the ceramic surface sometimes provided an important point of comparison for the positive casts to clarify the sequence of events represented in some cases, for example, where surface finish and decoration were sequentially applied to the original ceramic vessel. Failure to sort out these different applications to the ceramic will produce spurious reconstructions in other words (Petersen 1996a:9).

It is important to note that all of the fiber artifact technological types are somewhat provisional due to these and other difficulties inherent in reconstructing fiber artifacts from negative impressions. Nonetheless, the reconstructions should be generally accurate within the limits alluded to herein, especially given past experience in conducting such research (e.g., Petersen and Adovasio 1998; Petersen and Hamilton 1984), and the fact that an intensive review of each specimen was conducted, two or three times per specimen, using variable lighting to accentuate the subtle details. A binocular microscope (10-25x) was used as well, but this was only good for some details (e.g., determining spin in some cases) and it generally played only a complementary role to analysis under oblique lighting.

EXTANT SPECIMENS

At least 235 extant fiber specimens were recovered from a single cultural feature, feature 283, at site 51NW117. As noted above, feature 283 was a ceremonial burial pit and it included a notable cache of artifacts besides the highly fragmentary fiber artifacts, or "textiles." These fiber artifacts apparently represent both cordage and at most two separate twined fabrics, or specimens of fine basketry, which were included in feature 283. The loose cordage directly resembles cordage used as inactive, or "passive," warps in one of the fabrics, fabric no. 1, and it seems likely that all such loose specimens, including a minimum of 54 small fragments, were originally part of this fabric.

All of the extant specimens likely represent some sort of burial wrap, or shroud, perhaps even representing a large bag containing the burial and burial goods. As preserved, extant fiber artifacts were apparently found discontinuously over a horizontal distance of at least 1.20 cm x 75 cm, suggesting a relatively large original form, unless these were displaced post-depositionally, which seems unlikely. The surviving fragments were apparently preserved due to carbonization, indicating, along with other evidence, that a fire was burned in situ on the feature, perhaps after partial infilling. It seems that the surviving fragments of the fabric(s) are those which were partially burned. Most of the fabric(s) was lost, however, having been completely consumed in the fire, or lost later to decay where unburned (because of deeper burial than the surviving carbonized fragments and therefore having been kept from the flames).

Fabric no. 1 is represented by a minimum of 176 specimens of generally small size, while fabric no. 2 is represented seemingly by only two small specimens. The largest specimens related to fabric no. 1 are only about 44.65 mm x 19.75 mm, and 40.35 x 33.85 mm in size, documenting its highly fragmentary condition. The two specimens attributable to fabric no. 2 are maximally about 22.50 mm x 11.30 mm and 18.55 mm x 13.05 in size. Organics and sediments adhere to some specimens and all are seemingly carbonized, likely preserved due to this burned condition.

The less equivocal fabric, no. 1, is certainly a close simple twined textile, with wefts that are S-twist (or S-weft slant) in orientation. This fabric represents close twining because the wefts are closely spaced, largely obscuring the warps where they are not otherwise obscured by organics and sediments. It should be noted that what is likely this same fabric (as determined through slide photographs) has been alternatively interpreted by Marie Standifer as "interlacing" (or plaiting), where the two sets of elements were woven together, rather than twined. Of note, the author did not directly study those specimens sent to Standifer, nor did she study the much larger sample studied by the author, so it is possible that these samples indeed represent different fabrics. Standifer identified two raw material types in her samples, including monocot stems, probably a grass, in what are called here "wefts," and woody stems, probably basswood, in the cordage "warps."

In any case, as interpreted herein, fabric no. 1 is simple twining because a single warp is routinely engaged by each set of weft elements. The paired sets of elements used to S-twine this specimen are apparently unspun (or loosely spun?) vegetal fibers, summarized briefly below. In contrast, the warps are composed of vegetal cordage, again to be summarized below. The cordage is 2-ply, Z-spun and S-twist in most cases (n =44, or about 80% on the basis of the loose cordage), with a minority of 2-ply, S-spun and Z-twist cordage also represented among the warps (n=10, or about 20%).

The larger, coarser individual weft elements are ca. 2.50-3.05 mm in maximum diameter, while the weft pairs are about 3.30-3.80 mm in diameter. The warps are relatively fine, ca. 1.55-2.05 mm in maximum diameter, with individual plies only ca. 1.00-1.70 mm in diameter. In terms of compactness, there are about 1.8-2.0 warps per cm and there are 3.5-4.0 weft rows per cm, meaning that the warps are rather widely spaced and the wefts are fairly compact. Overall, the fabric would have been rather flexible, it seems.

The second, much more equivocal fabric, no. 2 (cat nos. 5007 B & C), may indeed represent a side selvage for fabric no. 1, or it may well represent a separate twined fabric, specifically open simple twining, as it is treated here, that is, its wefts are spaced widely rather than being placed close to one another, as they were in fabric no. 1. Although described separately here, fabric no. 2 is very similar to fabric no.1, except that the usage of unspun wefts and cordage warps is reversed in fabric no. 2. In this case, it demonstrates warps much like those described above for fabric no. 1 as wefts, which are again unspun vegetal fibers.

The active wefts for fabric no. 2 represent 2-ply, Z-spun, S-twist cordage, much like that used in fabric no. 1 as the inactive warps. Dimensions are generally similar between the two fabrics for the individual elements. As in fabric no. 1, the wefts exhibit an S-twist or weft slant. Fabric no. 2 may be clearly labeled as open simple twining, that is, simple twining with widely spaced weft rows. However, this is somewhat provisional because only one of the two specimens attributed to fabric no. 2 shows more than a single weft row. The weft elements are ca. 1.35-1.55 mm in diameter individually and about 1.75-2.45 mm in diameter as sets, while the warps are ca. 2.50-3.45 mm in maximum diameter.

Finally, the individual loose vegetal cordage specimens which are separate from either fabric, but presumably related to fabric no. 1, parallel the cordage clearly included in the fabrics, except in one case. The majority (ca. 80%) is 2-ply, Z-spun, S-twist and the minority (ca. 20%) is 2-ply, S-spun, Z-twist, documenting at least two types of cordage. A single specimen (cat. no. 5009-F) of the loose cordage is 3-ply, Z-spun, S-twist, with a diameter of ca. 3.50-6.20 mm, and it may represent some sort of tied off warp since one of the three plies almost appears wrapped around the others, while the other two may have been worked back into it. As discussed more completely below, the fiber artifacts reconstructed from the ceramics also demonstrate strong patterning in the spin and twist data, like that noted in the cordage warps and loose cordage among the extant samples.

NEGATIVE IMPRESSIONS ON POTTERY

As noted above, 70 different positive casts of fiber artifacts preserved on ceramics were used to reconstruct a larger sample of the original fiber artifacts as a point of comparison for the extant fabric fragments and to augment them. A slightly larger number of mended specimens would raise the actual number of ceramic sherds studied by 11, but the 70 specimens represent 70 original fiber artifacts. Of these, 23 directly studied specimens originated at the Peter House (51NW103), another 16 specimens were recovered from the Ramp 3 area (51NW117) and still another 13 specimens originated at Whitehurst West (51NW117W), for a total of 52 specimens directly studied (see Tables 1-3) (plus a few more that did not have fiber artifact impressions on them and which have been eliminated from this discussion). Another 18 specimens were only studied indirectly, that is, through black & white and color slide photographs; these specimens are less reliable reconstructions as a result (see Table 4).

The combined sample of 70 specimens is attributable to a total of five general technological types of fiber artifacts. These types include representation of close twined fabrics, open twined fabrics, cordage and netting, all used in surface finishing the exterior of the ceramics (although known elsewhere [e.g., Petersen and Hamilton 1984], no evidence of fiber artifacts used as a means of interior surface finish, or decoration for that matter, is represented herein). Also represented at Whitehurst, decoration was produced using cord-wrapped sticks (or dowels), a tool specifically made for pottery decoration, it seems, as well as cordage again. Brief descriptions of these categories follow.

As noted above in the description of the fabric(s) among the extant specimens, the difference between close and open twining is due to the closeness of the weft (or active element) rows, that is, whether they conceal the warps (or passive elements) around which they are twined, as in close twining, or leave the warps partially exposed, as in open twining. Both technological types are represented in the overall sample. Of these, the close twining is perhaps more easily recognizable in some ways, where distinctive weft rows are discerned, crossing warps with a nearly uniform regularity. In the close twining, the individual weft rows cross warps in a uniform or nearly uniform fashion, aligned much like cordage wrapped around a stick, but with clear evidence of aligned individual weft elements too. This is unlike cord-wrapped stick elements where cordage is only aligned in conjunction with the stick, rather than in conjunction with both warps and weft rows, as in twining. Nonetheless, where individual cord-wrapped stick elements were closely aligned and clearly parallel, they were sometimes difficult to differentiate from the close twining.

The close twining is not certainly simple twining since the warps are obscured and it can not be determined if one (or more) warps are consistently and simply engaged, or if they are engaged alternately, as in oblique twining, etc. However, the close twining nearly all shares relatively fine elements comparable to, or sometimes finer, than fabric no. 1 among the extant specimens. A few examples may be slightly coarser than fabric no. 1 and may even have rigid warps, rather than flexible ones, as the finer examples seem to exhibit (e.g., cat. no. 3243-6). These possible stiff-warped examples more resemble basketry in other words, whereas the much more typical finer examples are more like fabrics, as for the extant fabrics. They all would have been somewhat flexible, but the finer ones would have been likely more flexible. All of the close twined fabrics, other than extant fabric no. 1, postdate the unequivocal Middle Woodland period, except for a few which are attributed to the Middle-Late Woodland, meaning that is unclear which period they are attributed to, and several others directly dated to the late Middle Woodland period.

In the case of the open twined specimens, some of them might be typically labeled simply as “cordage” without more careful consideration. These specimens, largely attributable to the Early and Middle Woodland periods, all share a stretched form due to distortion caused when they were wrapped around a paddle, making it difficult to isolate which are wefts and which are warps. They generally resemble cordage-wrapped paddle impressions, except where interactive junctions are evident or suspected (due to characteristic distortions in the alignments of elements); many such examples seem to have been elsewhere labeled as “cord paddled” in previous analyses. It is possible that some of these actually represent “interlinked” fabrics made of cordage, that is, a single set of elements simply linked (or looped) around each other, like “knotless netting” (rather than twining), but some do appear to indeed represent open twining, as they are all called herein (Emery 1980:60-62). These are all extremely fine, loose, very flexible fabrics, made using cordage generally comparable to the extant specimens.

A second group of open twined specimens, all seemingly Late Woodland in age, were difficult to recognize as open simple twining at first, but they were ultimately differentiated from cordage paddled examples by crosscutting cordage elements which are aligned parallel to one another in some of the larger, better represented cases. Upon closer examination it was possible to see that the crosscutting elements were in fact widely spaced weft rows, engaging the aligned (but non-uniform) cordage warps in a generally perpendicular (but sometimes oblique) orientation. Distortion of the warps, where engaged by the wefts, further confirmed that these represent open twining. These would have been flexible fabrics.

Individual cordage identified as a form of cord-wrapped paddle surface finish was recognized where the elements lacked alignment and any evidence of interaction. In these cases, the cordage was sometimes of variable diameter and orientation, further corroborating assignment to this technological type, even though there is no direct evidence of the paddle per se. Most often, however, the cordage elements were uniformly quite fine and oriented closely parallel to one another. Nearly all examples seem to have been ca. 0.80-2.00 mm in diameter, as with all other cordage in the other technological types. Although rare in the extreme, an actual cord-wrapped paddle, preserved due to carbonization, is known from a late prehistoric context in Pennsylvania (Kent 1984:Figure 47).

Netting was also identified and most likely was used, like the cordage per se, in conjunction with a paddle. Obviously made of cordage, the netting seems remarkably fine in all cases, with small overall diameters, less than 1.0 mm it seems and comprised of very fine mesh, less than 1.0 cm in all cases. In fact, the fineness of the cordage used in the netting is surprising at first, but when taken in conjunction with the mesh size, it is quite clear that the netting used in the surface finish of ceramics was on the order of a very fine seine net, as might be used to capture all but the smallest fish, that is, all but very small minnows. Unfortunately, application of the net paddling seems to have largely obscured details about the knots in all, or nearly all cases, although they are very clearly recognizable as knots of some sort.

Cord-wrapped stick decoration was sometimes difficult to differentiate from the close twining, as noted above, in large part because of the fineness of cordage so employed, as well as the regularity employed during its application. However, where larger surface areas were preserved and/or chance showed overlapping, varying orientations, it was possible to discern that the elements had been individually applied. The cordage employed in the cord-wrapped stick tools was again comparable to the extant cordage and other specimens, including some very fine examples in this sample. One example (cat. no. 1440-1) here ascribed to the cord-wrapped stick type may have been, in fact, produced using the edge of a cord-wrapped paddle, that is, the paddle was tipped on its side for application. This alternative attribution is based on the close similarity between the cordage used in the surface finishing of this particular Late Woodland vessel and the cordage used in unequivocal subsequent application of limited bands of overlying cordage wrapped around some rigid foundation, namely a "stick," or perhaps the paddle edge.

The final category, cordage decoration, represents a very small group, limited to one vessel (cat. no. 1226-1) where the cordage elements probably were applied directly to the surface of the vessel individually and somewhat irregularly, suggesting that no paddle or other foundation was used in the application. Moreover, the cordage on this vessel was applied in a very narrow band, with smooth, "plain" areas both above and below it, and it was applied parallel to the upper edge of the lip, suggesting it was decoration and not a byproduct of surface finishing.

DATING AND INTRA-SAMPLE CORRELATIONS

Combining all of the available samples reported herein, the 72 fiber artifacts variably reconstructed from the Whitehurst Freeway Project at first seem like a small, somewhat inconsequential sample. Some are better known than others, but all are small and fragmentary. For example, there are 235 extant fragments attributable to at most two original fabrics, but even in this case, the original form(s) is poorly known. However, the importance of the combined sample increases immeasurably when it is recognized that such information is extraordinarily rare in the archaeological record in general and secondly, when they can be nearly all dated to one or another portion of the long Woodland period, overall dated ca. 1200 B.C. to A.D. 1500-1600 (e.g., Dent 1995; Egloff 1985). Besides the extant textiles, dated ca. A.D. 620-790, the other specimens can be grossly dated on the basis of the ceramics whereby they were preserved. Eight of the ceramic-derived fiber artifact reconstructions were also dated through AMS dating of carbonized residue on the interior surfaces of the ceramics. We can be sure of a one-to-one correspondence between the age of the fiber artifacts and the ceramics in any case.

It should be emphasized that all of the ceramic attributions were done by Parsons personnel and this information was kindly provided to the author, along with general estimates of temporal period attributions for each specimen, as cited herein. These data have been, in turn, correlated with the technological types used in this analysis (Table 5), providing very interesting evidence about continuity and change in the fiber artifacts over the duration of the available sample, essentially the span of the entire Woodland period, except perhaps the very earliest portion thereof.

Directly dated specimens derived from ceramics include an Early-Middle Woodland ceramic type, which was directly dated to 2210 $\pm$ 50 B.P., or 260 B.C. (uncorrected, as for all other dates herein), namely the Popes Creek ceramic type. This vessel (cat. no. 1331-1) from the Peter House (51NW103) (see Table 1) had been paddled with a net, but details are unfortunately scant due to degradation of the exterior surface. Three Middle Woodland fabrics (see Table 2) include an untyped Middle Woodland attribution, which was directly dated to 1710 ± 50 B.P., or A.D. 240, and it consists of an open simple twined (or interlinked?) fabric, with 2-ply S-twist cordage, probably Z-spun, from the Ramp 3 area (cat. no. 3225-9). Secondly, an untyped Middle-Late Woodland attribution was directly dated to 1440 B.P. ± 40 B.P., or A.D. 510, representing a close twined fabric, with Z-wefts, also from the Ramp 3 area (cat. no. 3095-14). Thirdly, a presumed Late Woodland attribution, directly dated to 1430 ± 50 B.P., or A.D. 520, represents another close twined fabric, with Z-wefts, and was also from the Ramp 3 area (cat. no. 3063-5). Parenthetically, the Ramp 3 area is where feature 283 and the extant textiles were recovered.

Still other direct dates were obtained for four ceramic specimens attributed to the Middle-Late Woodland or Late Woodland periods and so dated. These include one Middle-Late Woodland attribution of open simple twining (or interlinking?), with 2-ply, Z-spun, S-twist cordage, which was directly dated to 1180 ± 50 B.P., or A.D. 770, and thus matches its attribution and overlaps the dates for the feature 283 extant specimens. Of note, it also matches the dominant cordage among the extant fiber artifacts from feature 283. This specimen was recovered from Whitehurst West (cat. no. 6084-10). A Late Woodland attribution was confirmed for an example of close twining, with Z-wefts, which was directly dated to 1070 ± 50 B. P., or A.D. 880, also from Whitehurst West (cat. no. 6107-3) (see Table 3 for both).

Finally, the other two Late Woodland attributions include an example of a cordage-wrapped paddle, with two-ply, S-spun, Z-twist cordage, directly dated to 980 ± 60 B.P., or A.D. 970 (cat. no. 1357-1), and an example of open twining (or interlinking?), with comparable Z-twist cordage (cat. no. 1311-4). Both of these latter specimens were recovered from the Peter House (see Table 1 for both).

It is immediately obvious that certain technologies are represented throughout the 2500-year span, namely the broad categories of twining and cordage used in surface finish (see Table 5). However, among the reconstructed specimens, only open twining (assuming that it includes true open twining during the early periods, rather than just interlinking) persists over time. Close twining only seems to be reflected during the Middle-Late Woodland and Late Woodland periods. Extant fabric no. 1, however, is an unequivocal example of close twining during the Middle Woodland period, albeit the late portion thereof, whereas there are two examples of close twining, with Z-wefts, directly dated to the late Middle Woodland period, like the extant fabric(s), although their ceramic attributions alone would put them in the Late Woodland period.

Likewise, netting is only attributable to the Early-Middle Woodland, Middle Woodland and Middle-Late Woodland periods. As noted above, it has been directly dated to 260 B.C. at the Peter House. Like the representation of the open twining, this is likely only a sampling bias, confirmed generally across the region, dependent on the preferences of the aboriginal craftspeople in selecting surface finishing tools in the case of the netting, rather than a reflection of the possibility that the aboriginal craftspeople stopped making nets during the Late Woodland period. Rather, it seems much more likely that it became unfashionable to use netting to paddle pottery at this time.

Better preservation of actual extant specimens would likely show the existence of netting throughout (and before) the Woodland period in other words, just as the extant fabrics from feature 283 have provided otherwise un(der)represented details. Other discontinuities, such as the late appearance of cord-wrapped stick decoration, for example, may, in fact, mark the synchronous introduction of a new tool and technique of decorating ceramics over what was a huge area of eastern, primarily northeastern North America, as is amply demonstrated regionally and extraregionally (e.g., Petersen and Sanger 1991).

Perhaps the most striking discontinuity in the available data, and one that is likely to reflect cultural dynamics, rather than sampling bias or the bias of the original craftspeople, is that related to the reversal of the strongly dominant representation of S-twist and equivalent S-weft slants during the Early Woodland and Middle Woodland periods; some Z-twist/weft examples do appear in the Middle-Late Woodland attributed specimens, however, perhaps marking the transition. The only Z-twist examples unequivocally dated before the Late Woodland period, however, are the minority of cordage warps (ca. 18-20%) attributable to extant fabric no. 1, and the few examples of close twining, with Z-wefts, noted above. Out of a total of 24 other specimens preserved as ceramic impressions on pottery attributable solely to the Early Woodland or Middle Woodland periods, there are no examples of Z-twist or Z-weft slant in the entire sample!

After the onset of the Late Woodland period, Z-twist and Z-weft slant cordage and fabrics became clearly dominant, represented by 41 specimens, or about 89% of the total Late Woodland sample for which this attribute could be determined; five other Late Woodland examples exhibit S-twist or S-wefts, representing about 11% of the Late Woodland sample. In addition, as noted above, all seven specimens attributable to the Middle-Late Woodland period and for which this attribute could be determined likewise exhibit Z-twist or Z-wefts, without any representation of S-twist or S-wefts. Quite clearly, something drastic happened between the Middle Woodland and Late Woodland periods that caused the earlier, long-lasting pattern to be reversed by the onset of the Late Woodland period, after ca. A.D. 600-800.

As previously alluded to, one or the other cordage twist (and spin) and twining weft slant, as well as other attributes of technology and style, are normally very consistent within any one prehistoric or ethnographic population of fiber artifact makers. Moreover, on the basis of various archaeological samples world-wide we can say that such consistent patterns are often long lived, sometimes much longer lived than more obvious stylistic attributes, representing thousands of years of continuity in this regard (e.g., Adovasio 1986; Adovasio and Pedler 1994; Johnson 1996; Petersen 1996a, 1996b). Because of the limited choices and their ubiquity, cordage twist and weft slants alone do not conclusively establish the presence of a single cultural group without other corroborating evidence, because unrelated groups may fortuitously share common spin, twist and weft slant. However, shared usage of these attributes may well represent a common cultural heritage, while replacement of one pattern by another almost certainly denotes a significant cultural change of some sort. Any change in these patterns consequently bears careful consideration, both internally and regionally, most likely suggesting a population replacement.

EXTERNAL CORRELATIONS

Although exhaustive treatment of the relationships of the fiber artifacts documented in this report is not appropriate here, it is important to reiterate that the preservation of extant prehistoric textiles, even as fragmentary specimens, is extraordinarily rare in all areas of eastern North America. Thus, we know relatively little about these industries across the entire East strictly on the basis of extant specimens.

In the Mid-Atlantic region, the known and adequately reported examples of preceramic and Early Woodland, Middle Woodland and Late Woodland textiles are very few and far between, and even protohistoric and contact period specimens are rare (e.g., Andrews and Adovasio 1996; Carpenter 1950:Figures 90 and 91; Custer et al. 1990:47, Figure 18; Ferguson and Stewart 1940:Plates 4-6; Kent 1984:179-185; Kraft 1976; Ritchie 1969). Thus, extant fiber artifacts made by Native Americans provide suggestive, but limited information about their variability and distribution. Twining of various sorts, cordage and some plaiting are nonetheless relatively well represented among the extant samples, and the extant fabric(s) from Whitehurst would fit in conformably with others known thus far regionally, with the possible exception of the unusual combination of cordage warps with different initial spin and final twist in fabric no. 1. This combination seems regionally unique, at least among the small number of detailed and/or decipherable available reports. Regionally and to the north in New England, the use of cordage warps, rather than wefts, in twined fabrics is seemingly unique too, although sometimes both cordage warps and wefts were employed (e.g., Heckenberger et al. 1996).

The potential for reconstruction of native fiber industries through impressions on ceramics in both local and broad regional contexts shows much promise for teaching us about these crafts (e.g., Adovasio and Andrews [with Carlisle] 1980). However, in spite of the large numbers of ceramics that preserve such evidence all over the East, relatively few such studies have yet to be done, as noted above. This is due, in part, to a general lack of familiarity with such artifacts, difficulties in correctly interpreting them and the labor-intensive nature of the study. Local studies and others done elsewhere have clearly demonstrated the potential results, yet too often these data remain untabulated and impressionistic (e.g., Coe 1995:173-178). A few local studies have begun to correct this deficit, however.

Most notably, recognition of regional patterning in cordage twist and apparently weft slants has been previously recognized in the Potomac River and James River Estuary areas (e.g., Johnson 1996; Johnson and Speedy 1992). Working first in the James River Estuary, Johnson and Speedy (1992) noted a shift similar to that demonstrated herein in cordage and fabrics; it went from predominant S-twist and S-weft slant to predominant Z-twist and Z-weft slant over time. Notably, it occurred in that region in correlation with the transition from the Middle Woodland to Late Woodland periods, after ca. A.D. 800, as it did at Whitehurst, based on a study of sizeable samples from three sites and various ceramic types (Johnson and Speedy 1992:Tables 1-3).

More recently, Johnson (1996) has demonstrated a common use of Z-twist cordage among Late Woodland Potomac Creek and Montgomery ceramics, both upstream and downstream from Washington, D.C. These data corroborate the pattern seen at Whitehurst for the Late Woodland samples, but unfortunately do not include earlier examples. It would be interesting to see if these areas also exhibited S-twist and S-wefts during the Early Woodland and Middle Woodland periods, as among the Whitehurst examples. Nonetheless, these two studies provide very important background information for the present analysis, suggesting that the pattern demonstrated at Whitehurst is reflective of broader developments in the Coastal Plain, Piedmont and other zones along the Potomac River, and other nearby areas.

The precise significance of this change in material culture may well be debated and previous research has suggested late prehistoric intrusions into the region on other grounds, largely the ceramics themselves (see Dent 1995:245; Potter 1993). Nonetheless, previous research among ethnographic groups elsewhere has demonstrated near ubiquitous correspondence of particular cordage twists and weft slants with ethnic groups and broader language families as well, including the author's own research using over 1700 specimens from 89 tribes in Greater Amazonia (e.g., Petersen 1996a; Petersen et al. 1998). It is unnecessary to detail this argument here, but various researchers have presented it previously in different contexts.

CONCLUSIONS

The shift in cordage twist and twining weft slant demonstrated in the Whitehurst data may well be reflective of an actual population replacement in local and regional contexts between the Middle Woodland and Late Woodland periods. Alternatively, other hypotheses might be considered, albeit briefly. For example, it might be tempting to view this shift in twist and weft slant as arbitrary, caused by nothing more than some whimsical decision adhered to by the population of craftspeople, as when new ceramic decorations were adopted and others were abandoned regionally over time. This occurred rather randomly, or so it seems through the archaeological record, at least in many cases. However, knowledge of ethnographic and archaeological examples of fiber industries does not support this particular inference, largely because the attributes employed herein are so basic, representing "iconological" (equivalent in use) style, which does not operate like "iconological" (or identity signaling) style (see Petersen 1996a; Petersen et al. 1998). Continuity is quite strongly demonstrated in these cases. Thus, it is unlikely that stylistic change, as commonly conceived of, played a role in this shift.

Another similar but distinctive interpretation of this shift might be that it was correlated with the introduction of a new raw material, or materials, for the manufacture of fiber artifacts and that this brought a new spinning technique and therefore, a different final twist, as is known in some other archaeological examples where cotton was introduced, for example (e.g., Kent 1983). However, there is no visual evidence of such a transformation in apparent raw materials in this collection between the Middle Woodland and Late Woodland periods, but admittedly, it is difficult to be sure of this for the positive casts. Moreover, as has been recently demonstrated (Petersen et al. 1998), different final twists and weft slants are only rarely exhibited across different raw materials within any one population. Again, this alternative explanation seems unlikely to account for the demonstrated shift.

In the end, a population-related hypothesis seems most pertinent to the data, but it can not be conclusively demonstrated. It may be relevant to note that a similar shift happened in some portions of the region to the north in seeming correlation with the expansion, or crystallization, of Iroquoian-speakers at the beginning of, or later during, the Late Woodland period. In other words, wherever Iroquoians emerged, Z-twist and Z-wefts have been tentatively demonstrated, although more data are still needed to corroborate this hypothesis (Petersen 1996b). Although it may be just coincidental that an analogous shift also occurred at roughly the same time in the Mid-Atlantic region, it is certainly possible that broad-scale social dynamics were responsible in both cases and quite possibly interrelated, although not necessarily precisely similar. Data for the late prehistoric/contact Iroquoian-speaking Susquehannock would be useful for addressing this issue.

Previous researchers have noted the potential importance of having ethnographic Algonquian, Iroquoian and Siouan groups distributed across the Estuarine Coastal Plain to the Interior Coastal Plain and the Piedmont zones in the Mid-Atlantic region during the contact period (e.g., Egloff 1985; Potter 1993). Whatever the precise configuration of ethnic groups and language families 700-900 years earlier, at the time of the Middle Woodland to Late Woodland transition in this region, this configuration may well have played a role in the shift demonstrated herein and previously noted by Johnson.

In summary, this analysis has once again demonstrated the utility of carefully studying fiber artifacts, or "textiles," whenever and wherever they occur in the archaeological record. Although most analysts will not have the luxury of working with extant specimens, as was the case here, there is certainly much useful information to be gotten from the study of negative impressions preserved on aboriginal ceramics. The extant specimens described herein provide tantalizing evidence of the structural complexities inherent in some (or many?) examples that would be lost in the analysis of casts made from negative impressions. For example, the interesting (and unusual!) cooccurrence of two different types of cordage within extant fabric no. 1 would not likely have been identifiable if fabric no. 1, a close twined specimen as reconstructed herein, was only studied as a positive cast made from a negative impression. This is because warps are typically obscured in close twining, unless one can study the structure closely and carefully, and the full structure would not have likely shown in a positive cast.

Moreover, given the presence of extant specimens amenable to raw material analysis, Standifer's identification of the raw materials employed in the manufacture of what seems to be fabric no. 1 provides valuable evidence about raw material choices, and details about raw material processing. If one thinks the study of fiber artifacts is underemployed, the same can be said (and unfortunately, perhaps even more so) about identification of the raw materials used in their manufacture. Even if relatively few extant specimens are found in future excavations, there remain the numerous, previously excavated specimens which can be still studied in terms of their raw materials. They will certainly reward those who labor over them in the future.

The largest portion of the fiber artifact sample documented in this analysis did not directly survive in the archaeological record, but, instead, occur as negative impressions on prehistoric ceramics. Although it might be again emphasized that casting should be done carefully to minimize degradation and/or alteration of ceramic surfaces, among other media, the payoff from reconstructing these otherwise rare fiber artifacts is potentially very great indeed. They can provide information about these poorly known technologies at the same time that they provide information potentially useful in the study of prehistoric social groups, potentially including ethnicity and social identity. As demonstrated in this report, it may be another matter to "explain" this artifact patterning, but it is important to try nonetheless.

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REFERENCES CITED

Adovasio, James M.

1977 *Basketry Technology: A Guide to Identification and Analysis.* Aldine, Chicago.

1986 Artifacts and Ethnicity: Basketry as an Indicator of Territoriality and Population Movements in the Prehistoric Great Basin. In *Anthropology of the Desert West, Essays in Honor of Jesse D. Jennings*, edited by Carol J. Condie and Don D. Fowler, pp. 44-88. University of Utah Anthropological Papers 110. Salt Lake City.

Adovasio, James M., and Rhonda L. Andrews (with Ronald C. Carlisle)

1980 Basketry, Cordage and Bark Impressions from the Northern Thorn Mound (46MG78), Monongalia County, West Virginia. *West Virginia Archeologist* 30:33-72.

Andrews, Rhonda L., and James M. Adovasio

1996 The Origins of Fiber Perishables Production East of the Rockies. In *A Most Indispensable Art: Native Fiber Industries from Eastern North America,* edited by James B. Petersen, pp. 30-49. University of Tennessee Press, Knoxville.

Adovasio, James M., and David R. Pedler

1994 A Tisket, A Tasket: Looking at the Numic Speakers Through the "Lens" of a Basket. In *Across the West: Human Population Movement and the Expansion of the Numa,* edited by David B. Madsen and David Rhode, pp. 114-23. University of Utah Press, Salt Lake City.

Carpenter, Edmund S.

1950 Five Sites of the Intermediate Period. *American Antiquity* 15(4):298-314.

Coe, Joffre L.
1995 *Town Creek Indian Mound: A Native American Legacy.* University of North Carolina Press, Chapel Hill.

Custer, Jay F.
1989 *Prehistoric Cultures of the Delmarva Peninsula*. University of Delaware Press, Newark.

1996 *Prehistoric Cultures of Eastern Pennsylvania.* Pennsylvania Historical and Museum Commission, Harrisburg.

Custer, Jay F., Karen R. Rosenberg, Glenn Mellin, and Arthur Washburn
1990 An Update on New Research at the Island Field Site (7K-F-17), Kent County, Delaware. *Bulletin of the Archaeological Society of Delaware* 27:1-70.

Dent, Richard J.
1995 *Chesapeake Prehistory: Old Traditions, New Directions*. Plenum Press, New York.

Egloff, Keith T.
1985 Spheres of Cultural Interaction across the Coastal Plain of Virginia. In *Structure and Process in Southeastern Archaeology,* edited by Roy S. Dickens and H. Trawick Ward, pp. 229-242. University of Alabama Press, University.

Emery, Irene
1980 *The Primary Structure of Fabrics: An Illustrated Classification*. The Textile Museum, Washington, D.C.

Evans, Clifford
1955 *A Ceramic Study of Virginia Archeology*. Smithsonian Institution Bureau of American Ethnology Bulletin 160. Washington, D.C.

Ferguson, Alice L., and T. Dale Stewart
1940 An Ossuary Near Piscataway Creek and a Report on the Skeletal Remains. *American Antiquity* 6:4-18.

Hantman, Jeffrey L., and Michael J. Klein
1992 Middle and Late Woodland Archaeology in the Piedmont. In *Middle and Late Woodland Research in Virginia: A Synthesis*, edited by Theodore R. Reinhart and Mary Ellen N. Hodges, pp. 137-164. Archeological Society of Virginia Special Publication 29.

Heckenberger, Michael J., James B. Petersen, Frances B. King, and Louise A. Basa
1996 Fiber Industries from the Boucher Site: An Early Woodland Cemetery in Northwestern Vermont. In: *A Most Indispensable Art: Native Fiber Industries from Eastern North America,* edited by James B. Petersen, pp. 50-72. University of Tennessee Press, Knoxville.

Hurley, William M.
1979 *Prehistoric Cordage: Identifications of Impressions on Pottery*. Taraxacum, Washington, D.C.

Johnson, William C.
1996 A New Twist to an Old Tale: Analysis of Cordage Impressions on Late Woodland Ceramics from the Potomac River Valley. In *A Most Indispensable Art: Native Fiber Industries from Eastern North America,* edited by James B. Petersen, pp. 144-159. University of Tennessee Press, Knoxville.

Johnson, William C., and D. Scott Speedy
1992 Cultural Continuity and Change in the Middle and Late Woodland Periods in the Upper James Estuary, Prince Gorge County, Virginia. *Journal of Middle Atlantic Archaeology* 8:91-106.

Kent, Barry C.
1984 *Susquehanna's Indians.* Anthropological Series 6. Pennsylvania Historical and Museum Commission, Harrisburg.

Kent, Kate P.
1983 *Prehistoric Textiles of the Southwest*. University of New Mexico Press, Albuquerque.

Kraft, Herbert C.
1976 The Rosenkrans Site , An Adena-Related Mortuary Complex in the Upper Delaware Valley, New Jersey. *Archaeology of Eastern North America* 4:9-49.

Miner, Horace
1936 The Importance of Textiles in the Archaeology of the Eastern United States. *American Antiquity* 1(3):181-192.

Petersen, James B.
1996a The Study of Native Fiber Industries from Eastern North America: Resume and Prospect. In *A Most Indispensable Art: Native Fiber Industries from Eastern North America,* edited by James B. Petersen, pp. 1-29. University of Tennessee Press, Knoxville.

1996b Fiber Industries from Northern New England: Ethnicity and Technological Traditions during the Woodland Period. In *A Most Indispensable Art: Native Fiber Industries from Eastern North America,* edited by James B. Petersen, pp.100-119. University of Tennessee Press, Knoxville.

Petersen, James B., and James M. Adovasio
1998 Fiber Perishable Impressions. In *Prehistory of the Bay Springs Rockshelters, Volume 4: Prehistoric Ceramic Remains*, by James B. Petersen. Mercyhurst Archaeological Institute Reports of Investigations 3, in press.

Petersen, James B., and Nathan D. Hamilton
1984 Early Woodland Ceramic and Perishable Fiber Industries from the Northeast: A Summary and Interpretation. *Annals of Carnegie Museum* 53(14):413-445.

Petersen, James B., Michael J. Heckenberger, and Jack A. Wolford
1988 Spin, Twist and Twine: An Ethnoarchaeological Examination of Group Identity in Native Fiber Industries from Greater Amazonia. Paper presented at the conference, Fleeting Identities: Perishable Material Culture in Archaeological Research, Southern Illinois University, Carbondale.

Petersen, James B., and David Sanger
1991 An Aboriginal Ceramic Sequence for Maine and the Maritime Provinces. In *Prehistoric Archaeology in the Maritimes*, edited by Michael Deal and Susan Blair, pp. 121-178. Council of Maritime Premiers, Fredericton.

Potter, Stephen R.
1993 *Commoners, Tribute, and Chiefs: The Development of Algonquian Culture in the Potomac Valley.* University Press of Virginia, Charlottesville.

Ritchie, William A.
1969 *The Archaeology of New York State*. Natural History Press, Garden City.

Stewart, R. Michael
1994 *Prehistoric Farmers of the Susquehanna Valley: Clemson Island Culture and the St. Anthony Site*. Occasional Publications in Northeastern Anthropology 13.

LIST OF TABLES

TABLE 1. Attributes of Fiber Artifact Impressions from the Peter House Site (51NW103)

	PADDLED				DECORATION		TWIST/ WEFT SLANT		
ARTIFACT NUMBER	CLOSE TWINED	OPEN TWINED	CORDAGE	NETTING	CORD-WRAPPED STICK	CORDAGE	S	Z	?
1061-1				1			1		
1165-1				1			1		
1184-1		1					2		
1226-1						1		1	
1226-2		1					2		
1241-1	1							1	
1294-5				1			1		
1311-4		1						3	
1331-1				1?					1
1336-3					1			1	
1336-10				1			1		
1349-2					1			1	
1357-1			1					1	
1357-4				1?			1		
1371-6			1					1	
1397-12					1			1	
1405-19		1						2	
1416-6					1			1	
1440-1			1		1			2	
1450-1	1							1	
1458-2	1?							1	
1466-3		1						2	
1467-1					1			1	
TOTALS (n=23)	3	5	3	6	6	1	9	21	1

TABLE 2. Attributes of Fiber Artifact Impressions from the Ramp 3 Site (51NW117)

	PADDLED				DECORATION		TWIST/WEFT SLANT		
ARTIFACT NUMBER	CLOSE TWINED	OPEN TWINED	CORDAGE	NETTING	CORD-WRAPPED STICK	CORDAGE	S	Z	?
210-3					1			1	
3018-41	1							2	
3063-4	1							1	
3063-5	1							1	
3095-2					1			1?	
3095-4	1						1		
3095-6	1							1	
3095-7	1							2	
3095-14	1							1	
3188-9					1			1	
3215-1					1			1	
3225-9		1					2		
3243-3		1?							1
3243-6	1							1	
3247-1	1							1	
3257-3	1							1	
TOTALS (n=16)	10	2	0	0	4	0	3	15	1

TABLE 3. Attributes of Fiber Artifact Impressions from the Whitehurst West Site (51NW117W)

	PADDLED				DECORATION		TWIST/WEFT SLANT		
ARTIFACT NUMBER	CLOSE TWINED	OPEN TWINED	CORDAGE	NETTING	CORD-WRAPPED STICK	CORDAGE	S	Z	?
6019-3					1			1	
6043-14				1?				1	
6073-2		1						2	
6084-10		1					2		
6084-11			1				1		
6093-7&8	1				1			2	
6102-13			1					1	
6107-3	1							1	
6155-78			1				1		
6156-9					1			1	
6174-11	1							1	
6187-10					1			1	
6188-5		1						2	
TOTALS (n=13)	3	3	3	1	4	0	4	13	0

TABLE 4. Attributes of Fiber Artifact Impressions Reconstructed from Photographs*

	PADDLED				DECORATION		TWIST/ WEFT SLANT		
ARTIFACT NUMBER	**CLOSE TWINED**	**OPEN TWINED**	**CORDAGE**	**NETTING**	**CORD-WRAPPED STICK**	**CORDAGE**	**S**	**Z**	**?**
51NW103									
1294-13	1							1	
1337-5				1					1
1392-3		1					2		
1398-3			1?				1		
1428-2				1					1
1429-1				1			1		
51NW117									
210-6	1?								1
3006-1				1			1		
3188-7	1							1	
3215-2		1					2		
3225-10			1				1		
51NW117W									
6030-21			1						1
6030-24			1?						1
6092-1			1				1		
6148-5	1							1	
6159-2			1?						1
6176-7	1							1	
6187-8			1?				1		
TOTALS (n=18)	5	2	7	4	0	0	10	4	6

*Specimens which mend with others analyzed, and those which do not exhibit fiber impressions are not included here.

TABLE 5. Distribution of Fiber Artifact Attributes byTemporal Periods and Ceramic Types*

	PADDLED				DECORATION		TWIST/ WEFT SLANT		
TEMPORAL PERIOD/ CERAMIC TYPE	**CLOSE TWINED**	**OPEN TWINED**	**CORDAGE**	**NETTING**	**CORD-WRAPPED STICK**	**CORDAGE**	**S**	**Z**	**?**
Early Woodland									
Accokeek	-	3	2	-	-	-	8	-	-
Selden	-	-	2	-	-	-	2	-	-
Untyped	-	-	3	-	-	-	3	-	-
Early-Middle Woodland									
Popes Creek	-	-	-	6	-	-	4	-	2
Middle Woodland									
Mockley	-	1	-	2	-	-	4	-	-
Untyped	-	1	-	2	-	-	3	-	1
Middle-Late Woodland									
Untyped	4	-	-	1	3	-	-	7	1
Late Woodland									
Shepard/ Potomac Creek	-	3	3	-	2	1	2	9	1
Townsend	16	4	1	-	9	-	3	33	-
Unknown	-	-	2	-	-	-	1	-	1
TOTALS (n=70)	20	12	13	11	14	1	30	49	6

*Includes all specimens itemized in Tables 1-4, with questionable attributions assigned to most likely category.